PATENT SPECIFICATION
DRAWINGS ATTACHED

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International Classification:—C 03 b (E 04 f)

COMPLETE SPECIFICATION

Improvements in or relating to Glass Panels which Exhibit Optical Effects

I, RUPERT NIKOLL, an Austrian citizen of Wien III., Weyrgasse 5, Austria, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a glass panel which exhibits optical effects, particularly a cover panel for light sources, which panel has a surface which has a projecting profile and a fire finish at least adjacent to the projections.

Such glass panels have been known for a long time. They are manufactured on a large scale, e.g., in the known workshops at Murano, Italy. In the process used there, the desired profile is manually impressed by means of sheet metal molds similar to pastry cutters into the plastically deformable material spread on an appropriate base. Only persons having great experience and skill are employed in the manufacture. Even when these requirements are fulfilled, however, the amount of rejects in manufacture is relatively large. For this reason and owing to the handicraft methods of manufacture, such panels are highly expensive.

It has been proposed to provide the hot glass composition in a frame lying on a flat base plate and to smooth the glass composition to uniform thickness, then to remove the upper frame part and impress a pattern with the aid of a die so that the protruding portions of the die bear on the lower part of the frame to ensure the desired, uniform depth. This process has the disadvantage that the size of the panels being manufactured is determined by the size of the die so that a separate die is required for each size of panel. The process is also expensive because dies of various sizes must be kept in stock for each pattern. This disadvantage may be eliminated if the die is replaced by a molding roller, which is moved at such a distance from the base that the profile portions protrudng from the surface of the roller penetrate only partly into the plastically deformable material and cause the material laterally displaced by them to bulge into the cavities between the protruding profile portions of the roller without contacting the roller surface. This enables the manufacture of panels of any desired length.

All panels manufactured by these processes, however, have the disadvantage that their manufacture permits of providing them with a fire finish only on one side so that the light-diffusing and light-retracting effects of these panels, i.e., the optical effects exhibited by them, are not entirely satisfactory. In such panels having protruding profile portions a special lustre may be obtained according to the present invention by a fire finish on both surfaces and projections consisting of bulges which are formed directly out of the heated glass and each having in its protruding portion, particularly at its apex on one side, a reduced wall thickness to promote the diffusion of light.

The invention provides also a process of manufacturing such panels, in which a mold is unilaterally and locally caused to act on the glass which is applied in a deformable condition in a substantially uniform thickness on a base provided with outlet openings for a gaseous fluid and with a frame, whereafter a mold is disposed opposite the surface of the heated glass, which glass is blown with the aid of a pressure fluid and with or without the aid of suction into cavities between the protruding profile portions of the mold to form the heated glass in the cavities between the profile portions of the

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mold with bulges which are formed directly out of the glass have a fire finish on both sides, and a reduced wall thickness. The pressure fluid may be compressed air.

Preferably the profile of the panel is formed by the mold, which mold comprises a molding roller movable relatively to the base at a given height thereover so that profile portions protruding from the roller penetrate only partly into the heated glass on the base, and the underside of the heated glass is subjected to the action of the gaseous pressure fluid from outlet openings adjacent to the roller during movement of the roller.

The heated glass on the base may alternatively be drawn between the mold comprising a molding roller rotatably mounted on a stationary axis and the base plate which is disposed below this roller, and the outlet openings in the base plate may each be in the form of a groove which extends parallel to the axis of the roller. Valves for controlling the escape of the gaseous pressure fluid from the outlet openings, which openings are in the form of grooves parallel to the axis of the roller, may be controlled by the molding roller. Finally, the heated glass may be spread on the surface on a bottom plate which lies on the base and is formed with a slot parallel to the roller axis, whereafter the bottom plate disposed between the non-moving, heated glass and the base is moved together with the molding roller over the base in the same direction and at the same speed as the roller, whereas gaseous pressure fluid is constantly fed to the slot in the bottom plate through a longitudinal grooved forming the outlet openings in the base. The roller may be used to cut at least one longitudinal edge of the panel in known manner simultaneously with the formation of the profile in the profiled panel to be made.

This invention relates also to apparatus for carrying out the process according to the invention, which apparatus comprises a base on which the heated glass may be spread and a mold disposed opposite to this base, and which is characterized in that the base is provided with a frame and at least one opening, which opening is connected by a duct to a source of a gaseous pressure fluid, and that the mold is maintained at a predetermined distance over the base. The mold is grid-shaped and at least parts thereof may form wall portions of a vacuum chamber connected to a vacuum pump. The mold may comprise a molding roller and be provided at both ends with guide discs for determining the distance of the roller from the base and the depth by which profile portions of the molding roller penetrate into the heated glass during the rolling operation. The base may be formed with groove-shaped openings for the gaseous fluid, which openings are suitably evenly spaced and parallel to the axis of the roller. The mold may comprise a molding roller rotatably and vertically adjustably mounted in a fixed position above a groove-shaped opening formed in the base and provided with a stripper or holding-down member for the heated glass, and the frame for the glass is slidable on the base. The groove-shaped openings provided in the base may be provided with shut-off valves having actuating members protruding above the surface of the base plate and the mold may comprise a molding roller provided with a disc which contacts the base and serves for successively actuating these valves. The apparatus may comprise a bottom plate formed with a slot parallel to the axis of the molding roller and disposed between the stationary base and the heated glass, the slot in the plate being disposed below the roller and the roller and the bottom plate being adapted to be moved together in the same direction and at the same speed over the heated glass held stationary, by means of the frame.

The invention will be explained more fully hereinafter with reference to illustrative embodiments shown on the accompanying drawing, in which

Fig. 1 is a diagrammatic elevation showing a panel according to the invention,

Fig. 2 a sectional view taken on line II—II in Fig. 1,

Fig. 3 a diagrammatic representation of the prior art method of manufacturing the panels,

Fig. 4 a top plan view showing a plate-like mold placed on a mold frame,

Fig. 5 a sectional view taken on line V—V in Fig. 4,

Fig. 6 a sectional view taken on line VI—VI in Fig. 4,

Fig. 7 in a diagrammatic view a plate-like mold in conjunction with a vacuum chamber,

Fig. 8 a longitudinal sectional view taken on line VIII—VIII in Fig. 9 through a molding roller arranged over the base plate,

Fig. 9 a section taken on line IX—IX in Fig. 8,

Fig. 10 a diagrammatic view showing a molding roller rotatably mounted above a groove formed in the base plate, which groove is parallel to the axis of the roller,

Fig. 11 is a diagrammatic front elevation showing partly in section an apparatus in which the grooves in the base plate are formed with shut-off slide valves and the molding roller is arranged to operate these valves,

Fig. 12 is a side view showing this apparatus, and

Fig. 13 a diagrammatic view showing an apparatus provided with a bottom plate which is disposed between the heated glass and the stationary support and is jointly

movable with the molding roller in the same direction.

The panel 1 shown in Figs. 1 and 2 is provided with bulges 2 formed directly in the heated glass and have a fire finish on both sides, that is to say, the surfaces of the bulges are free from macroscopic as well as microscopic cracks or gaps. The fire finish results from contact of the heated glass with compressed air or other pressure fluid as hereinafter described. In their protruding portion, particularly at their apex 3, have a reduced wall thickness to promote the diffusion of light. The shape and extent of the bulges may vary within a wide range. It is not necessary to provide such bulges throughout the panel. The panels according to the invention are particularly suitable as cover plates for light sources and may be assembled in configurations which cannot be made or can be made only with difficulty as integral bodies; as a result, the panels may form covers for large light sources.

Fig. 3 shows basically the previous manufacture of the panels, in which a die or a profiled roller is forced to a predetermined depth into the deformable material 5 spread in a surface on a base plate 4 so that the die or roller causes the glass displaced by the bars 6 of the die to bulge in the cavities between the bars without contacting the carrier plate 7 of the die. As a result, the fire finish of the bulges is preserved. As has been mentioned hereinbefore, the panels made by this known process have the disadvantage of having a fire finish only on one side and resembling lustrous pressed glass because the bulges have an almost uniform height.

The embodiment of an apparatus for carrying out the process according to the invention shown in Figs. 4 to 6 comprises a base in the form of a base plate 8, which is formed in its top surface with a plurality of groove-shaped openings 6, which communicate through ducts 10 with a source of compressed air, not shown. A mold frame 11 placed on the base plate 8 serves for receiving the heated glass and for determining its thickness. A platelike mold 12 having a grid structure is secured on this mold frame. The mold 12 is preferably assembled from flat iron bars 13 placed on edge. When in such an apparatus compressed air, e.g., is supplied from the source of compressed air through the ducts 10 to the openings 9 and is caused to act on the underside of the heated glass to form the bulges, the same will be urged into the cavities between the grid bars 13 of the mold 12 to form bulges in such cavities, which bulges distinguish not only by excellent light-diffusing and light-refracting effects owing to the fire finish on both sides but also by a desired irregularity imparting to the panels an artistic character.

The wall thickness of the bulges is reduced, particularly at the apex, by the selection of an appropriate thickness of the layer of the spread glass, the depth of penetration of the mold, the blowing pressure applied and its controlled application, and the temperature of the glass. In this way the bulges are formed to exhibit the effect of a divergent lens, which further increases the optical effect achievable with such panels.

In the apparatus diagrammatically shown in Fig. 7, similar to that shown in Figs 4 to 6, the mold 12 forms a wall of a vacuum chamber 14 and the predominating internal pressure causing the heated glass to bulge is caused also by evacuating the vacuum chamber 14 through an opening 15 thereof.

Instead of a platelike mold, the apparatus shown in Figs. 8 and 9 comprising base 8, openings 9, ducts 10 and frame 11 as in Figs. 4 to 6, uses a molding roller. Such roller comprises an axially extending carrying spindle 16 having screw-threaded ends 17 and carrying discs 19 separated by spacers 18. The discs 19 may, e.g., have a corrugated rim and are replaceable to produce different patterns. In the present case the spacers 18 consist of sleeves, which are smaller in external diameter than the discs 19 and provided with recesses 20 for inserting radially extending profile sections 21 consisting of cross-bars. The present embodiment comprises five rows of such evenly spacer profile sections 21. The discs 19 and the transverse profile sections 21 consist preferably of sheet metal having a thickness of, e.g., 1 to 3 mm. The edge of the profile sections 21 may also have fine corrugations. If desired, the spindle 16 may carry an entirely irregular mold pattern. Guide discs 23 are provided at both ends of the spindle 16 to space the roller from the heated glass by a distance which enables the same to bulge freely in the cavities 22 between the protruding profile portions of the roller and at the same time determines the depth of penetration of the mold. The guide discs 23 have internal screw threads and are in threaded engagement with the ends 17 of the spindle 16 so that the discs 19 and spacers 18 fitted on the mandrel 16 are firmly held between the discs 23. Close to their ends the molding roller is provided with cutting discs 24, which trim the lateral longitudinal edges of the panel strip while the mold is urged into the heated glass. The panel strip formed by the continuous movement of the molding roller over the heated glass of uniform thickness in the mold frame 11 can be cut into equal lengths if the roller is provided with at least one knife, which extends throughout the length of the roller as far as to the lateral cutter discs 24 or, e.g., the profile

sections 21 of one row may be so high that they penetrate into the heated glass to the same depth as the lateral cutter discs 24 to sever the panel sections along transverse lines.

In the apparatus diagrammatically shown in Fig. 10, the molding roller is rotatably mounted in a stationary position, preferably so as to be vertically adjustable, above a groove-shaped opening 9 which is formed in the base plate 8 and extends transversely of the duct 10. The molding roller may cooperate with a stripper, if desired. In this embodiment the heated glass 5 spread in a surface on the base plate 8, e.g., in a mold frame 11, is drawn between the base plate 8 and the molding roller.

In the apparatus diagrammatically shown in Figs. 11 and 12, the groove-shaped openings 9 and the ducts 10 formed in the base plate 8 are controlled by spring-loaded shut-off slide valves 25, which are themselves controlled by the molding roller. For this purpose, each shut-off valve 25 is provided with an actuating pin 26 which extends to the surface of the base plate 8 and outside the perimeter of a mold frame 11. The free end of the pin 26 carries an actuating button 27 which protrudes from the base plate 8. The molding roller is provided at one end with a disc 28, which, during relative traverse movement of the roller and the base, contacts the base and successively depresses the buttons 27 to open the respective valves 25 during the rotation and the said relative movement of the disc 28.

The apparatus shown in Fig. 13 comprises a bottom plate 29 disposed between the heated glass 5 and the base plate 8 and having a slot 30. A molding roller on a spindle 16 disposed vertically over the slot 30 can be moved with the bottom plate 29 in the same direction and at the same speed but the heated glass 5 is held arranged to be held stationary by a frame 11. Compressed air is constantly fed throught ducts 10 and the longitudinal groove 9 in the base plate 8 to the slot 30 in the bottom plate.

The panels are formed from transparent, colourless or coloured glass as well as translucent homogeneous glass. The optical effect due to the refraction and/or diffusion of light may be varied in many ways by providing the bulges in appropriate shapes and arrangements.

WHAT I CLAIM IS:—

1. A glass panel which exhibits optical effects, particularly a cover panel for light sources, which panel has a fire finish on both surfaces and projections consisting of bulges formed directly out of the glass in heated state and each having in its protruding portion, particularly at its apex on one side, a reduced wall thickness to promote the diffusion of light.

2. A glass panel which exhibits optical effects, substantially as described hereinbefore with reference to and as shown in Figs. 1 and 2 of the accompanying drawings.

3. A process of manufacturing a glass panel as claimed in claim 1 or 2, in which a mold is unilaterally and locally caused to act on the glass which is applied in a deformable condition in substantially uniform thickness on a base provided with outlet openings for a gaseous fluid and with a frame, whereafter a mold is disposed opposite the surface of the heated glass, which glass is blown with the aid of a pressure fluid and with or without the aid of suction into cavities between the protruding profile portions of the mold to form the heated glass in the cavities between the profile portions of the mold with bulges which are formed directly out of the heated glass, have a fire finish on both sides, and a reduced wall-thickness.

4. A process as claimed in claim 3, characterized in that the pressure fluid is compressed air.

5. A process as claimed in claim 3 or 4, characterized in that the profile of the panel is formed by the mold, which mold comprises a molding roller movable relatively to the base at a given height thereover so that profile portions protruding from the roller penetrate only partly into the heated glass on the base, and the underside of the heated glass is subjected to the action of the gaseous pressure fluid from outlet openings adjacent to the roller during movement of the roller.

6. A process as claimed in claim 3, characterized in that the heated glass on the base is drawn between the mold comprising a molding roller rotatably mounted on a stationary axis and the base plate which is disposed below this roller, and in that the outlet openings in the base plate are each in the form of a groove which extends parallel to the axis of the roller.

7. A process as claimed in claim 5, characterized in that valves for controlling the escape of the gaseous pressure fluid from the outlet openings, which openings are in the form of grooves parallel to the axis of the roller, are controlled by the molding roller.

8. A process as claimed in claim 5, characterized in that the heated glass is spread on a surface on a bottom plate which lies on the base and is formed with a slot parallel to the roller axis, whereafter the bottom plate disposed between the non-moving, heated glass and the base is moved together with the molding roller over the base in the same direction and at the same speed as the roller, whereas gaseous pressure fluid is constantly fed to the slot in the bottom plate through a longitudinal groove forming the outlet openings in the base.

9. A process of manufacturing glass panels

exhibiting optical effects, substantially as described hereinbefore with reference to Figs. 4 to 13 of the accompanying drawings.

10. Apparatus for carrying out a process as claimed in any of claims 3 t 9 comprising a base on which the heated glass is spread and a mold disposed opposite to this base, characterized in that the base is provided with a frame and at least one opening, which opening is connected by a duct to a source of a gaseous pressure fluid, and that the mold is maintained at a predetermined distance over the base.

11. Apparatus as claimed in claim 10, characterized in that the mold is grip-shaped and at least parts thereof form wall portions of a vacuum chamber connected to a vacuum pump.

12. Apparatus as claimed in claim 10, characterized in that the mold comprises a molding roller and is provided at both ends with guide discs for determining the distance of the roller from the base and the depth by which profile portions of the molding roller penetrate into the heated glass during the rolling operation and that the base is formed with groove-shaped openings for the gaseous fluid, which openings are suitably evenly spaced and parallel to the axis of the roller.

13. Apparatus as claimed in claim 10, characterized in that the mold comprises a molding roller rotatably and vertically adjustably mounted in a fixed position above a groove-shaped opening formed in the base and provided with a stripper or holding-down member for the heated glass, and the frame for the glass is slidable on the base.

14. Apparatus as claimed in claim 10, characterized in that groove-shaped openings provided in the base are provided with shut-off valves having actuating members protruding above the surface of the base plate and the mold comprises a molding roller provided with a disc which contacts the base and serves for successively actuating these valves.

15. Apparatus as claimed in claim 10, characterized by a bottom plate formed with a slot parallel to the axis of the molding roller and disposed between the stationary base and the heated glass, the slot in the plate being disposed below the roller and the roller and the bottom plate being adapted to be moved together in the same direction and at the same speed over the heated glass held stationary by means of the frame.

16. Apparatus for manufacturing glass panels which exhibit optical effects, substantially as described hereinbefore with reference to and as shown in Figs. 4 to 13.

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Agents for the Applicant.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig.1

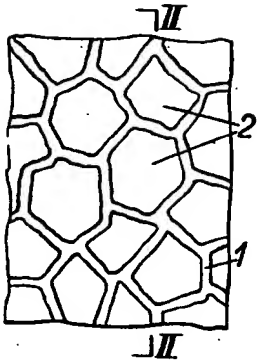


Fig.2

Fig.3

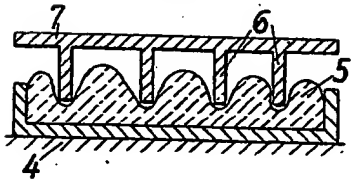


Fig.7

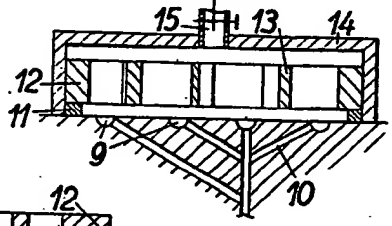


Fig.6

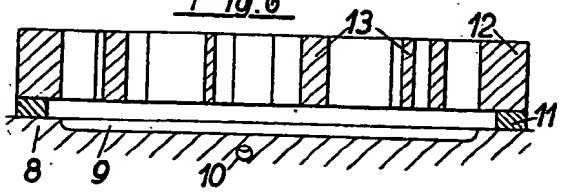


Fig.5

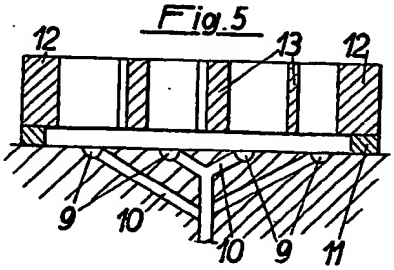
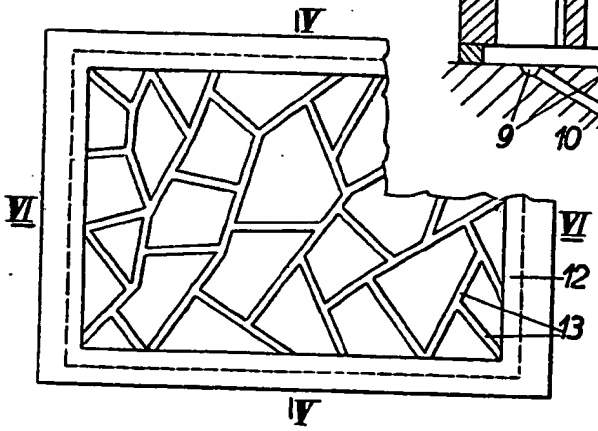


Fig.4



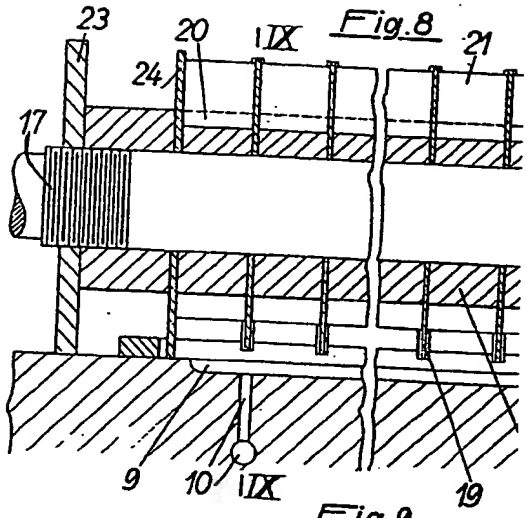


Fig.8

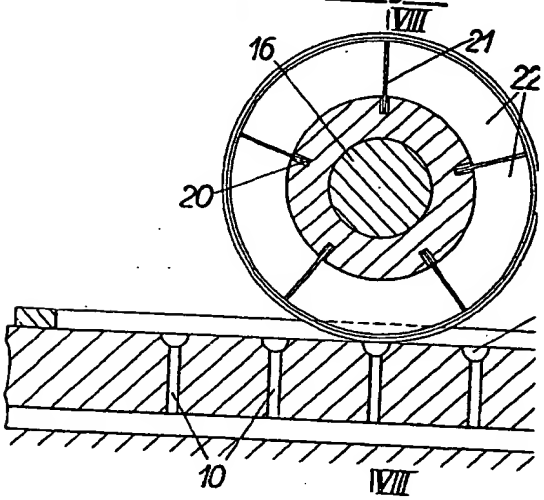


Fig.9

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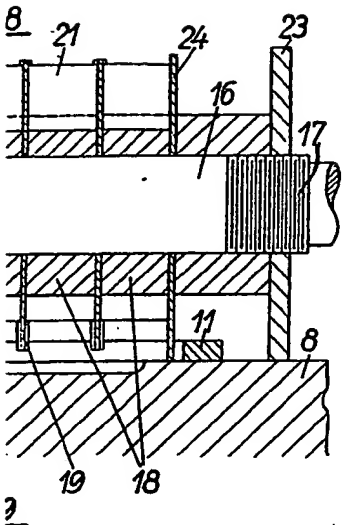
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3



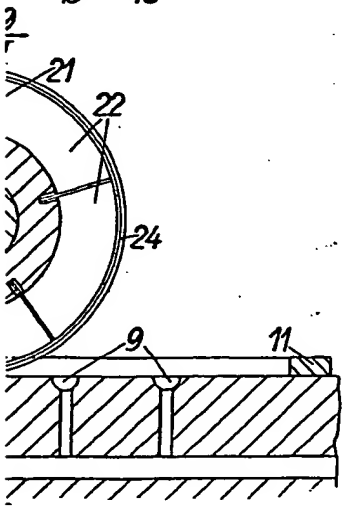


Fig.10

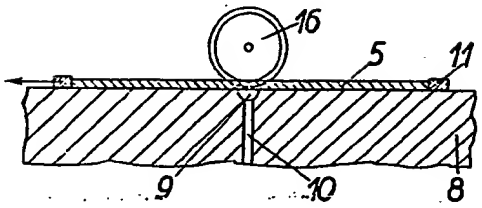


Fig.11

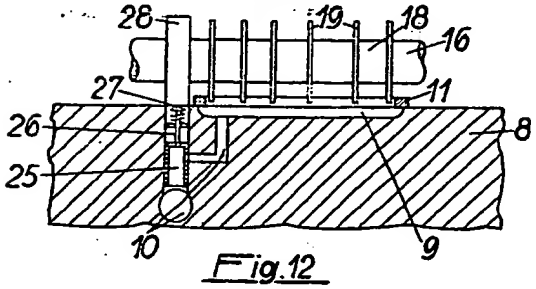


Fig.12

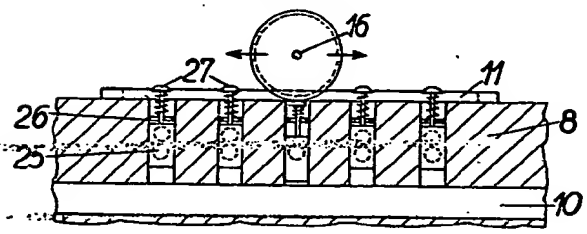


Fig.13

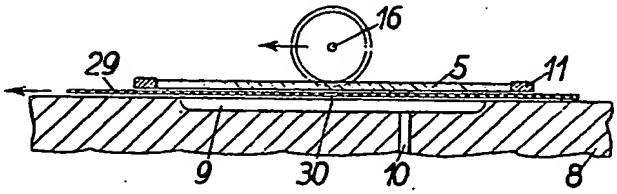


Fig.8

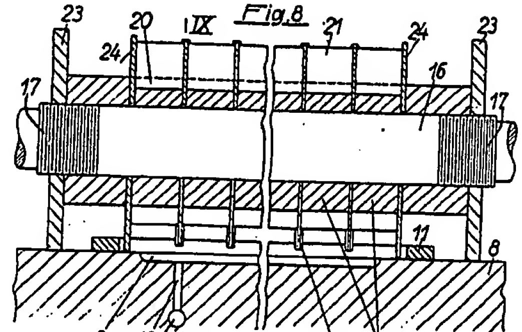


Fig.9

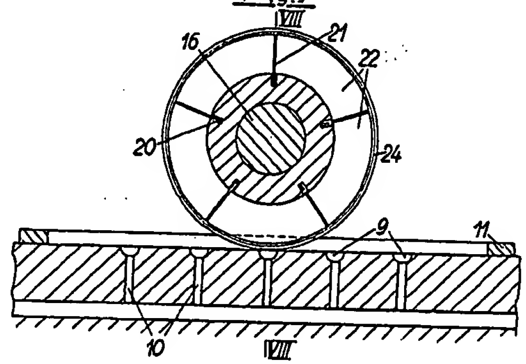


Fig.10

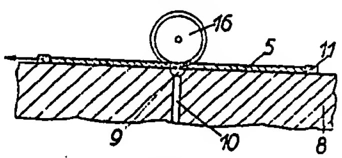


Fig.11

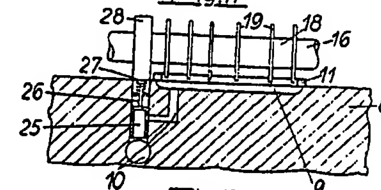


Fig.12

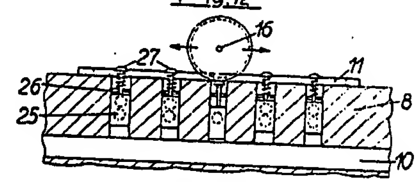


Fig.13